Appendix A:

```
Precalculation data processing:
@FOpen 'c:\tanager\multis.txt',1,FileNum
@For i = 1 To ACs
   @FRead
FileNum,EOF,AssetClass[i,1],AssetDesc[i,1],AssetCategory[i,1],TotalAssetsPct[i,1],ACAssetsTol[i,1],Appreciation[i,1],Dividend[i,1],
CapGainstax[i,1],Yield[i,1],CGDist[i,1],TaxBracket[i,1],Clt_Id,Turnover[i,1],CurrTax[i,1],CurrTaxDef[i,1]
   @If Turnover[i,1] = 0.0
      @Assign Turnover[i,1] = Horizon
   @EndIf
   @Assign YieldPlus1[i,1] = 1.0 + Yield[i,1]
   @rem debug YieldPlus1[i,1] + ' = ' + '1.0' + ' + ' + Yield[i,1]
   @Assign YieldPlus1[i,1] = YieldPlus1[i,1] ^ Horizon
   @rem debug YieldPlus1[i,1] + ' = ' + YieldPlus1[i,1] + ' ^ ' + Horizon
   @Assign HorizonMinus1 = Horizon - 1
   @Assign DividendPlus1[i,1] = Dividend[i,1] + 1.0
   @Assign AppreciationPlus1[i,1] = Appreciation[i,1] + 1.0
   @Assign ValueAfterTaxMult[i,1] = (Appreciation[i,1] + (Dividend[i,1] - (Dividend[i,1] * TaxBracket[i,1])) + (CGDist[i,1] -
(CGDist[i,1] * CapGainstax[i,1])))
   @rem debug ValueAfterTaxMult[i,1]
   @Assign ValueAfterTaxMultPlus1[i,1] = 1.0 + ValueAfterTaxMult[i,1]
   @Assign ValueAfterTaxMultPlus1[i,1] = ValueAfterTaxMultPlus1[i,1] ^ Horizon
   @rem debug  ValueAfterTaxMultPlus1[i,1]
   @Assign StockRate[i,1] = Appreciation[i,1] + Dividend[i,1] + CGDist[i,1]
   @Assign StockRatePlus1[i,1] = StockRate[i,1] + 1.0
   @Assign StockRatePlus1[i,1] = StockRatePlus1[i,1] ^ Horizon
   @Assign StockApprRateOnGoing[i,1] = Appreciation[i,1] - (Appreciation[i,1] * CapGainstax[i,1])
   @Assign StockApprRateOnGoingPlus1[i,1] = StockApprRateOnGoing[i,1] + 1.0
   @Assign StockDivRateOnGoing[i,1] = Dividend[i,1] - (Dividend[i,1] * TaxBracket[i,1])
   @Assign StockDivRateOnGoingPlus1[i,1] = StockDivRateOnGoing[i,1] + 1.0
   @Assign StockGrowthRateOnGoing[i,1] = Appreciation[i,1] + StockDivRateOnGoing[i,1]
   @Assign StockGrowthRateOnGoingPlus1[i,1] = StockGrowthRateOnGoing[i,1] + 1.0
   @Assign BondRateOnGoing[i,1] = Yield[i,1] - (Yield[i,1] * TaxBracket[i,1])
   @debug  BondRateOnGoing[i,1] + ' = ' + Yield[i,1] + ' - (' + Yield[i,1] + ' * ' + TaxBracket[i,1] + ')'
   @Assign BondRateOnGoingPlus1[i,1] = BondRateOnGoing[i,1] + 1.0
   @debug  BondRateOnGoingPlus1[i,1] + ' = ' + BondRateOnGoing[i,1] + ' + ' + '1.0'
   @Assign BondRateOnGoingPlus1[i,1] = BondRateOnGoingPlus1[i,1] ^ Horizon
   @debug  BondRateOnGoingPlus1[i,1] + ' = ' +  BondRateOnGoingPlus1[i,1] + ' ^ ' + Horizon
   @rem debug AssetClass[i,1] + ' ' + AssetDesc[i,1] + ' ' + TotalAssetsPct[i,1] + ' ' + ACAssetsTol[i,1] + ' ' + Appreciation[i,1] + ' ' +
Dividend[i,1] + ' ' + CapGainstax[i,1] + ' ' + Yield[i,1] + ' ' + AssetCategory[i,1] + ' ' + CGDist[i,1] + ' ' + TaxBracket[i,1] + ' ' + Clt_Id +
' ' + Turnover[i,1] + ' ' + CurrTax[i,1] + ' ' + CurrTaxDef[i,1]
@Next I
```

Initialization

```
@rem debug 'Starting Initialisation...'
@DelFile 'C:\tanager\results.txt', 1

@Assign LethalValue = 0.0
@Assign ACsMinus1 = ACs - 1
@Assign Tmax = TotalAssets - TDmax
@Assign ValueBest = 0.0

@Do AllocateClasses_prc

@Do CurrentValue_prc

@Do WriteInitial_prc
```

AllocateClasses_prc

```
@rem **** PERCENT OF ASSETS IN EACH ASSET CLASS
@For i = 1 To ACs
 @Assign  ACAssets[i,1] = TotalAssets * TotalAssetsPct[i,1]
 @rem debug  ACAssets[i,1] + ' = ' + TotalAssets + ' * ' + TotalAssetsPct[i,1]
@Next I
```

CurrentValue_prc

```
@rem debug '**** DETERMINE VALUE OF CLIENT CURRENT ALLOCATION'
@For i = 1 To ACs
  @Assign ACT[i,1] = CurrTax[i,1]
  @Assign ACTD[i,1] = CurrTaxDef[I,1]
  @rem debug ACT[i,1] + ' ' +  ACTD[i,1]
@Next
i
@rem debug 'Doing  ValueForCurrent_prc'
@Do ValueForCurrent_prc

@For i = 1 To ACs
    @Assign ACTCurrBest[i,1] =  ACTBest[i,1]
    @Assign ACTDCurrBest[i,1] =  ACTDBest[i,1]
    @Assign ACValueCurrBest[i,1] = ACValueBest[i,1]
    @rem debug  ACTCurrBest[i,1] + ' ' + ACTDCurrBest[i,1] + ' ' + ACValueCurrBest[i,1]
@Next i
@Assign ValueCurrBest = ValueBest
@rem debug ValueCurrBest

@rem debug '**** REINITIALIZE'
@Assign ValueBest = 0.0
@For i = 1 To ACs
  @If AssetDesc[i,1] = 'Municipal'
    @Assign ACT[i,1] = ACTD[i,1] + ACT[i,1]
    @Assign ACTD[i,1] = 0.0
  @EndIf
@Clear Value
@rem InitArray ACT
@rem InitArray ACTD
@InitArray ACTBest
@InitArray ACTDBest
@InitArray ACValueBest
```

WriteInitial_prc

```
@rem **** WRITE INITIAL GENERATION FILE
@FOpen 'c:\tanager\initgen.txt', 2, FileNum

@rem for k = 1 To 50

  @Assign ACInit[1,1] = CurrTaxDef[i,1]
  @Str ACInit[1,1] , StgNum
  @Assign  InitGen = StgNum

  @For i = 2 To ACs
    @Assign ACInit[i,1] = CurrTaxDef[i,1]
    @Str ACInit[i,1] , StgNum
    @Assign  InitGen = InitGen + ', ' + StgNum
  @Next i

  @FWrite FileNum, InitGen
```

```
@rem Next k

@FClose FileNum
```

Value Function

```
@Assign Value = 0.1

@rem **** The GA generates values for ACTD, and we calculate ACT
@For ı = 1 To ACs
  @Assign ACT[ı,1] = ACAssets[ı,1] - ACTD[ı,1]
  @rem debug  ACT[i,1] + ' = ' + ACAssets[ı,1] + ' - ' + ACTD[ı,1]
@Next ı

@Do Lethal_prc

@Assign Terminate = 'No'
@IF Value <> LethalValue
  @rem **** Loop through all Asset Classes
  @For i = 1 To ACs
        @rem **** Check for Stock or Bond
        @If AssetCategory[ı,1] = 'Stock'
          @Do ValueStock_prc
        @Else
          @Do ValueBond_prc
        @EndIf
        @Assign Value = Value + ACValue[ı,1]
        @rem debug 'ı = ' + ı + #10 + 'ACTD[ı,1] = ' + ACTD[ı,1] + #10 + 'ACT[ı,1] = ' + ACT[ı,1] + #10 + 'Value = ' + Value + ' ValueBest = '
+ ValueBest
  @Next ı
  @rem debug 'ı = ' + i + #10 + 'ACTD[ı,1] = ' + ACTD[ı,1] + #10 + 'ACT[ı,1] = ' + ACT[ı,1] + #10 + 'Value = ' + Value + ' ValueBest = ' +
ValueBest
  @IF (Value <> LethalValue) AND (Value > ValueBest)
    @Assign ValueBest = Value
    @For i = 1 To ACs
      @Assign ACTBest[ı,1] = ACT[ı,1]
      @Assign ACTDBest[ı,1] = ACTD[ı,1]
      @Assign ACValueBest[ı,1] = ACValue[ı,1]
    @Next ı
  @EndIf
@ENDIF
```

Lethal_prc Procedure

```
@Assign Terminate = 'No'

@Assign TDTotal = 0.0

@For  i = 1 To ACs

 @If (ACTD[i,1] < 0) or (ACTD[i,1] > ACAssets[i,1])
   @Assign Terminate = 'Yes'
 @Else
   @Assign TDTotal = TDTotal + ACTD[i,1]
 @EndIf

@Next i

@rem if (TaxBracket[i,1] = 0) and (ACTD[i,1] <> ACAssets[i,1])
  @rem Assign Value = LethalValue
@rem EndIf

@If (TDTotal > TDmax) OR (Terminate = 'Yes')
  @Assign Value = LethalValue
```

```
@EndIf
```

ValueStock_prc Procedure

```
@rem **** COMPUTE SIMPLE FUTURE VALUE

@Assign ACTDBase[i,1] = ACTD[i,1] * StockRatePlus1[i,1]

@If Turnover[i,1] = Horizon
  @rem '**** TAXABLE STOCKS'

  @If OptMethod = 'Liq'
    @rem **COMPUTE BASE VALUE AT HORIZON
    @Assign BaseValue[i,1] = 1+Appreciation[i,1]+Dividend[i,1]+CGDist[i,1]
    @Assign BaseValue[i,1] = ACT[i,1] * BaseValue[i,1]^Horizon

    @rem ** COMPUTE TAXABLE CAPITAL GAIN
    @Assign AppreciationValue[i,1] = (1+Appreciation[i,1]+CGDist[i,1])
    @Assign AppreciationValue[i,1] = ACT[i,1] * AppreciationValue[i,1]^Horizon

    @rem ** COMPUTE CAP GAINS TAX
    @Assign CapGainOnTaxableStocks[i,1] = AppreciationValue[i,1] * CapGainstax[i,1]

    @rem ** COMPUTE DIVIDENDS
    @Assign DividendVal[i,1] =  Dividend * TaxBracket
    @Assign DividendVal[i,1] = 1 + Dividend - DividendVal[i,1]
    @Assign DividendVal[i,1] = ACT[i,1] * DividendVal[i,1]^Horizon

    @rem **** COMPUTE ACTUAL VALUE OF TAXABLE STOCKS
    @Assign ACTValue[i,1] = AppreciationValue[i,1] - CapGainOnTaxableStocks[i,1] + DividendVal[i,1]
    @rem debug ' ACT[i,1]: ' + ACT[i,1] + #10 + ' BaseValue[i,1]: ' + BaseValue[i,1] + #10 + ' AppreciationValue[i,1]: ' +
AppreciationValue[i,1] + #10 + ' CapGainstax[i,1]: ' + CapGainstax[i,1] + #10 + ' CapGainOnTaxableStocks[i,1]]. ' +
CapGainOnTaxableStocks[i,1] + #10 + ' DividendVal[i,1]: ' + DividendVal[i,1] + #10 + ' ACTValue[i,1]: ' + ACTValue[i,1]

  @Else
    @Assign ACTValue[i,1] = ACT[i,1] * ValueAfterTaxMultPlus1[i,1]
  @EndIf
@Else
  @DO TurnOver_prc
@EndIf

@rem **** TAX DEFERRED STOCKS
@If OptMethod = 'Liq'
  @Assign TaxOnTaxDefStocks[i,1] = ACTDBase[i,1] * TaxBracket[i,1]
  @Assign ACTDValue[i,1] = ACTDBase[i,1] - TaxOnTaxDefStocks[i,1]
@Else
  @Assign ACTDValue[i,1] = ACTDBase[i,1]
@EndIf

@rem **** FINAL VALUE
@Assign ACValue[i,1] = ACTValue[i,1] + ACTDValue[i,1]
```

ValueBond_prc Procedure

```
@rem COMPUTE SIMPLE FUTURE VALUE

@Assign ACTDBase[i,1] = ACTD[i,1] * YieldPlus1[i,1]

@rem **** TAXABLE BONDS
@If OptMethod = 'Liq'
  @Assign ACTValue[i,1] = ACT[i,1] * BondRateOnGoingPlus1[i,1]
  @rem debug  i + ': ' + ACTValue[i,1] + ' = ' +  ACT[i,1] + ' * ' +  BondRateOnGoingPlus1[i,1]
  @rem Assign ACTTax[i,1] = (ACTValue[i,1] - ACT[i,1]) * TaxBracket[i,1]
  @rem Assign ACTValue[i,1] = ACTValue[i,1] - ACTTax[i,1]
@Else
```

```
  @Assign ACTValue[i,1] = ACT[i,1] * BondRateOnGoingPlus1[i,1]
@EndIf

@rem **** TAX DEFERRED BONDS
@If OptMethod = 'Liq'

  @Assign ACTDTax[i,1] = ACTDBase[i,1] * TaxBracket[i,1]
  @Assign ACTDValue[i,1] = ACTDBase[i,1] - ACTDTax[i,1]
   @rem debug ACTDTax[i,1] + ' = ' + ACTDBase[i,1] + ' * ' +  TaxBracket[i,1]
   @rem debug  ACTDValue[i,1] + ' = ' + ACTDBase[i,1] + ' - ' + ACTDTax[i,1]
@Else
  @Assign ACTDValue[i,1] = ACTDBase[i,1]
@EndIf

@rem **** FINAL VALUE
@Assign ACValue[i,1] = ACTValue[i,1] + ACTDValue[i,1]
@rem debug ACValue[i,1] + ' = ' + ACTValue[i,1] + ' + ' + ACTDValue[i,1]
```